

1. A piezoelectric element in which electrodes are arranged on both sides of a piezoelectric film respectively, wherein said piezoelectric film is provided with an oxide layer containing 0 or not more than 15 weight percent of Pb arranged on a face of the piezoelectric film, said face being in contact with at least one of the electrodes, and said oxide layer being formed of a composite oxide expressed by a chemical formula  $ABO_3$  or of a solid solution of one or not less than two kinds of composite oxides respectively expressed by the chemical formula  $ABO_3$ .

2. The piezoelectric element according to claim 1, wherein said oxide layer is formed of: a composite oxide a expressed by said chemical formula,  $ABO_3$ , in which A is one or not more than two kinds of elements selected among a group of alkaline-earth metals and Pb and B is one or not more than two kinds of elements selected among a group of Ti, Zr, and Sn; a composite oxide b expressed by said chemical formula,  $ABO_3$ , in which A is one or at least two kinds of elements of alkaline-earth metals and B is Nb and/or Ta; or a solid solution of said composite oxide a and said composite oxide b.

3. The piezoelectric element according to claim 1 ~~or 2~~, wherein an oxide forming said oxide layer is a ferroelectric material.

4. The piezoelectric element according to any of claims 1 to 3, wherein said oxide layer contains not more than 5 weight percent of Pb.

5. The piezoelectric element according to <sup>claim 1</sup> ~~any of claims 1 to 4~~, wherein said piezoelectric film is formed of a composite oxide expressed by a chemical formula,  $\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$  ( $0.1 \leq x \leq 1$ ) or formed of a material mainly composed of the composite oxide.

6. The piezoelectric element according to <sup>claim 1</sup> ~~any of claims 1 to~~  
8, wherein said piezoelectric film is formed of a solid solution

of a composite oxide expressed by a chemical formula,  $a\text{PZT-b}$   
 $[\text{Pb}(\text{C}_{1/3}\text{D}_{2/3})\text{O}_3$  (C : alkaline-earth metals such as Mg, Zn, Ni, Mn, Co  
 or Fe; D : V, Nb or Ta)] - c [(Ba<sub>1-y</sub>Sr<sub>y</sub>)TiO<sub>3</sub> ( $0 \leq y \leq 1$ )] ( $a+b+c=1$ ,  $0.6$   
 $\leq a \leq 1$ ,  $0 \leq b \leq 0.4$ ,  $0 \leq c \leq 0.05$ ) ( $\text{Pb}(\text{C}_{1/3}\text{D}_{2/3})\text{O}_3$  is hereinafter referred  
 5 to as "PCD", and  $(\text{Ba}_{1-y}\text{Sr}_y)\text{TiO}_3$  is hereinafter referred to as "BSTO").

7. The piezoelectric element according to <sup>claim 1</sup> ~~any of claims 1 to~~  
 6, wherein said oxide layer is  $0.05 \mu\text{m}$  to  $1 \mu\text{m}$  in thickness.

8. The piezoelectric element according to <sup>claim 1</sup> ~~any of claims 1 to~~  
 7, wherein said piezoelectric film is  $1 \mu\text{m}$  to  $25 \mu\text{m}$  in thickness.

10 9. The piezoelectric element according to <sup>claim 1</sup> ~~any of claims 1 to~~  
 8, wherein said oxide layer is not more than 10% of said piezoelectric  
 film in thickness.

15 10. A process for producing a piezoelectric element comprising:  
 a first electrode forming step in which an electrode is formed  
 on a substrate;

a piezoelectric film forming step in which a piezoelectric  
 film is formed on said electrode; and

a second electrode forming step in which another electrode  
 is formed on said piezoelectric film;

20 wherein an oxide layer forming step in which an oxide layer  
 is formed is performed between said first electrode forming step  
 and said piezoelectric film forming step and/or between said  
 piezoelectric film forming step and said second electrode forming  
 step.

25 11. The process for producing a piezoelectric element according  
 to claim 10, wherein said oxide layer is formed in said oxide layer  
 forming step by solution-phase method using metallic alkoxide and/or  
 metallic salt as a starting material.

30 12. The process for producing a piezoelectric element according  
 to claim 10 ~~or 11~~, wherein said piezoelectric film is formed in said

oxide layer forming step by solution-phase method using metallic alkoxide and/or metallic salt as a starting material.

13. An ink-jet printer head provided with an ink, and in which capacity of an ink chamber communicating to said ink nozzle through an ink passage is changed by an actuator, and ink is jetted from said ink nozzle through said ink passage,

wherein the piezoelectric element according to <sup>claim 1</sup> ~~any of claims~~

~~1 to 9~~ is used as said actuator.

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